

Claims

1. A system using reformat for reducing oxides of nitrogen (NOx) in the exhaust of a hydrocarbon-fueled, internal combustion engine which operates with fuel from a source and air from an air inlet and which provides engine exhaust in an exhaust pipe, comprising:

5 reformat means having an inlet and an outlet for providing at said outlet a flow of said reformat including at least hydrogen, said means comprising either (a) a hydrogen generator and a tank of water, said hydrogen generator receiving, at an inlet of said hydrogen generator, fuel from said source and a mixture comprising air from
10 said air inlet humidified with moisture from said tank, or (b) a homogeneous non-catalytic partial oxidizer receiving, at an inlet of said partial oxidizer, fuel from said source and unhumidified air from said air inlet; and

15 NOx reducing means receiving said engine exhaust and said reformat for reducing the NOx in said engine exhaust to provide system exhaust with diminished NOx.

2. A system according to claim 1 wherein said output of said reducing means comprises no more than about 0.4 grams/bhp/hr NOx.

3. A system according to claim 1 wherein said output of said reducing means comprises no more than about 0.28 grams/bhp/hr of non-methane hydrocarbons.

4. A system according to claim 1 further comprising:
a heat exchanger for vaporizing engine fuel before said fuel is added into said mixture.

5. A system according to claim 1 wherein said reformat means comprises an air bubbler which humidifies air.

6. A system according to claim 5 wherein said air bubbler is separate from said tank.

7. A system according to claim 5 further comprising:
a heat exchanger receiving humidified air out of said air bubbler to heat the humidified air with hot engine exhaust.

8. A system according to claim 1 wherein said NO_x reducing means comprises at least one NO_x trap, each NO_x trap alternately trapping NO_x in said exhaust and being regenerated by said outflow of reformat.

9. A system according to claim 1 wherein said NO_x reducing means comprises an NO_x reducing catalytic converter.

10. A system according to claim 1 wherein said hydrogen generator is selected from an auto-thermal reformer, a catalytic partial oxidizer and a homogeneous non-catalytic partial oxidizer.

11. Apparatus for diminishing oxides of nitrogen (NO_x) in the exhaust of a system including a hydrocarbon-fueled engine that provides engine exhaust containing NO_x, said apparatus comprising:

a tank of water;

5 means for generating reformat from a mixture of air humidified with moisture derived from said tank of water and engine fuel, to provide a flow of reformat including hydrogen and carbon monoxide; and

10 means for using the flow of reformat for reducing NOx in said engine exhaust to provide system exhaust with diminished NOx.

12. A method of diminishing oxides of nitrogen (NOx) in the exhaust of a system including a hydrocarbon-fueled engine that provides engine exhaust containing NOx, said method comprising:

5 generating reformat from a mixture of air humidified by moisture derived from a tank of water and engine fuel, to provide a flow of reformat including hydrogen and carbon monoxide; and

using the flow of reformat for reducing NOx in said engine exhaust to provide system exhaust with diminished NOx.

13. A method according to claim 12 wherein:

said generating step comprises reforming a mixture containing vaporized fuel.

14. A method according to claim 13 wherein:

said generating step comprises vaporizing fuel by heat exchange with said exhaust.

15. A method according to claim 12 wherein:

said generating step comprises humidifying air in an air bubbling humidifier receiving water from said tank of water.

16. A method according to claim 12 wherein:
said generating step comprises humidifying air in an air
bubbling humidifier which serves as said tank for said water.
17. A method according to claim 12 wherein:
said step of reducing NO_x comprises applying said exhaust
and said flow, contemporaneously, to a NO_x reducing catalytic
converter.
18. A system according to claim 12 wherein:
said step of reducing NO_x comprises alternately applying said
engine exhaust and said flow to at least one NO_x trap, separately.